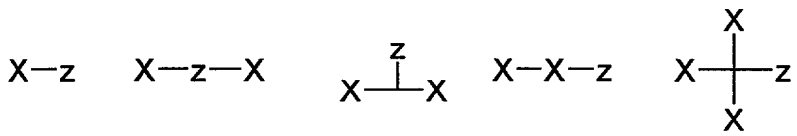
WHAT IS CLAIMED IS:

1. A microcapsule comprising an encapsulated material enclosed within a solid permeable shell of a polymer resin wherein the polymer resin has incorporated therein at least one surface modifying compound wherein said surface modifying compound is selected from compounds having a formula (I), (II), (III) (IV) or (V)



(I) (II) (III) (IV) (V)

wherein Z is a moiety that contributes to modifying the surface properties of said microcapsule and each X is, independently, a functional moiety capable of reacting with a wall-forming material and the moieties designated by lines linking the X and Z functional groups have a molecular weight of between 50 and 4000, and may be optionally substituted aryl, hydrocarbyl, or heterocyclic units, or combinations thereof, optionally containing internally linked amino, ether, thioether, acetal, ester, thioester, amide, sulphonamide, urethane, urea, carbonate, siloxane, or phosphonamide groups or combinations thereof.

2 A microcapsule according to claim 1 wherein -X in structures (I) to (III) and (V) is hydroxyl, thiol, a group –NHA wherein A is hydrogen or C_1 to C_4 alkyl or a group -CO-OR where R is hydrogen or a hydrocarbyl moiety having 1-30 carbon atoms optionally linked or substituted by one or more halo, amino, ether or thioether groups or combinations of these or wherein in structure (IV) -X- is -NH-.

3. A microcapsule according to claim 1 or 2 wherein -Z comprises sulphonate, carboxylate, phosphonate, phosphate, quaternary ammonium, betaine, oxyethylene or an oxyethylene-containing polymer.

4. A microcapsule according to claim 3 wherein

when -Z is sulphonate, carboxylate, phosphonate or phosphate it is present as a salt providing the $-Z^-$ anion or

wherein when -Z is quaternary ammonium it has the structure

$[-NR_1R_2R_3]^+ A'^-$

wherein R_1, R_2 and R_3 are independently hydrogen or C_1 to C_4 alkyl and A'^- is a suitable inorganic or organic anion such as halide or acetate provided that not more than one of R_1, R_2 and R_3 is hydrogen

or wherein

when -Z is oxyetheylene or an oxyethylene-containing polymer, it is an oxyethylene polymer or a random or block oxyethylene/oxypropylene copolymer containing an oxyethylene to oxypropylene ratio of grater than 1.

5. A microcapsule according to any of the preceding claims wherein the surface modifying compound of structure (I) has the formula

$$X\text{-}Y_1\text{-}Z \qquad (IA)$$

wherein Y_1 represents the moiety linking X and Z and is a straight or branched chain alkyl linking group containing from 1 to 20 carbon atoms; or is phenyl, naphthyl, cyclopentyl or cyclohexyl; or

or wherein when Z is an oxyethylene containing polymer and Y_1 represents a direct link between X and Z the surface modifying compound of structure (I) has the formula structure (IB)

$$R_4\text{-}O(PO)_r(EO)_s\text{ - }X \qquad (IB)$$

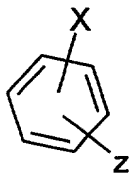
wherein R_4 is an end-capping group which is C_1 to C_4 alkyl, r, and s are independently from 0 to 3000, provided that s is not 0 and the total of r + s is from about 7 to about 3000 and EO and PO represent oxyethylene and oxypropylene respectively which may be arranged in random or block formation; or

or wherein when Z is an oxyethylene/oxypropylene block copolymer and Y_1 represents a direct link between X and Z the surface modifying compound of structure (I) has the formula (IC)

$$R_4'\text{-}O(PO)_{r'}(EO)_{s'}(PO)_t\text{- }X \qquad (IC)$$

wherein R_4' is an end-capping group which is C_1 to C_4 alkyl, r', s' and t are independently from 0 to 2000, provided that s is not 0 and the total of r' + s' + t is from about 7 to about 3000 and EO and PO represent oxyethylene and oxypropylene respectively; or

wherein when Y_1 is a ring structure group, the surface modifying compound of structure (I) has the formula (ID)



(ID)

wherein X and Z are as defined previously or if X and Z are adjacent substituents capable of reacting together they may form a cyclic anhydride capable or ring-opening under the reaction conditions.

6. A microcapsule according to any of claims 1 to 4 wherein the surface modifying compound of structure (II) wherein -Z- is an oxyethylene containing polymer and there is a direct bond between -Z- and each –X has the formula (IIIA)

$$X\text{-}(EO)_a(PO)_b\text{-}X' \qquad \text{(IIA)}$$

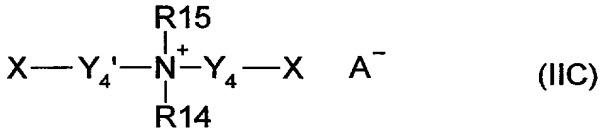
wherein a and b are independently from 0 to 3000, provided that a is not 0 and the total of a + b is from about 7 to about 3000 and EO and PO represent oxyethylene and oxypropylene respectively which may be arranged in random or block formation; or

wherein the surface modifying compound of structure (II) wherein -Z- is an ethylene oxide, propylene oxide block copolymer and there is a direct bond between -Z- and each –X has the formula (IIB)

$$X\text{-}(PO)_{a'}(EO)_{b'}(PO)_c\text{-}X' \qquad \text{(IIB)}$$

wherein a', b' and c are independently from 0 to 2000, provided that b is not 0 and the total of a' + b' + c is from about 7 to about 3000 and EO and PO represent oxyethylene and oxypropylene respectively; or

wherein -Z- in structure (II) is quaternary ammonium and structure (II) has the formula (IIC)



(IIC)

wherein R_{14} and R_{15}, which may be the same or different, are hydrogen C_1 to C_{20} straight or branched chain alkyl; aryl; or C_1 to C_4 aralkyl, wherein each aryl group may be optionally substituted by C_1 to C_4 alkyl, nitro or halo and Y4 and Y4' which may be the same or different are

$-R_8-$ or

$-R_7-(L_1)_n-$

wherein R_7, and R_8 are independently C_1 to C_{10} straight or branched chain alkyl linking groups optionally substituted by halogen or C_1 to C_4 alkoxy and $(L_1)_n$ is a polyoxyalkyene group; n is from 2 to 20 and A- is a suitable anion.

7. A microcapsule according to any of claims 1 to 4 wherein the surface modifying compound of structure (III) has the formula (IIIA)

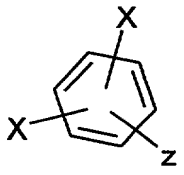
$$X\text{-}Y_2\text{-}C(Z)(R_6)\text{-}Y_2'\text{-}X' \qquad \text{(IIIA)}$$

wherein R_6 is hydrogen or more preferably a C_1 to C_4 alkyl group optionally substituted by ether, for example C_1 to C_4 alkoxy or halogen and Y_2 and Y_2', which may be same or different are independently

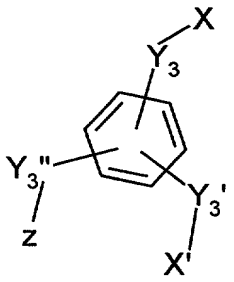
$-R_7-(L_1)_n-$ or

$-R_8-$

wherein R_7, and R_8 are independently C_1 to C_{10} straight or branched chain alkyl linking groups optionally substituted by halogen or C_1 to C_4 alkoxy and $(L_1)_n$ is polyoxyethylene, polyoxypropylene or polyoxybutylene; n is from 2 to 20, preferably from 4 to 10; or wherein the surface modifying compound of structure (III) wherein the moiety linking X and Z is a ring structure group has the formula (IIIB) or (IIIC)



(IIIB)



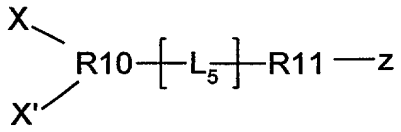
IIIC

wherein Y_3, Y_3' and Y_3'' individually represent a direct link between X or Z (as the case may be) and the ring structure or may be a group

$-(L_2)-R_9$

where L_2 is an ester linking group –C(O)-O-, R_9 is oxyethylene, oxypropylene or oxybutylene or polyoxyethylene, polyoxypropylene or polyoxybutylene having a degree of polymerisation from 2 to 20; or

wherein the surface modifying compound of structure (III) has the formula (IIID)



IIID

wherein R_{10} is a C_1 to C_8 straight or branched chain alkyl group and the two groups X and X', which may be the same or different, may be attached to the same carbon atom in the alkyl chain or to different carbon atoms in the alkyl chain, $-L_5-$ a linking group which is

$-(L_1)_n-$ or

$-R_8-$

wherein R_8, and $(L_1)_n$ are as defined above in relation to formula IIIA and R_{11} is C_1 to C_4 alkyl.

8. A microcapsule according to any of claims 1 to 4 wherein the surface modifying compound of structure (IV) has the formula (IVA)

X-Y-NH-Y'-Z (IVA)

wherein Y and Y' include independently a straight or branched chain C_1 to C_{10} alkyl group, a polyoxyethylene, polyoxypropylene or polyoxybutylene polymer chain of formula $-(L_1)_n-$ as defined above or a group $-(L_2)-R_9-$ as defined above.

9. A microcapsule according to any of the claims 1 to 4 wherein the surface modifying compound is a sulfonate polyester polyol prepared by reacting sodium sulphoisophthalic acid, adipic acid, cyclohexane dimethanol, methoxy-polyethylene glycol (mw 750) and trimethylol propane to give a product having a hydoxyl number in the range of from 150 to 170.

10. A microcapsule according to any of the preceding claims wherein the solid permeable shell of polymer resin is made by isocyanate polymerisation and the surface modifying compound reacts with the isocyanate moiety in the wall forming material.

11. A microcapsule according to claim 10 wherein the isocyanate wall forming material is tolylene diisocyanate or an isomer thereof, phenylene diisocyanate or an isomer thereof, biphenylene diisocyanate or an isomer thereof, polymethylenepolyphenyleneisocyanate

(PMPPI), hexamethylene diisiocyanate (HMDI) or a trimer therof or isophoronediisocyanate (IPDI).

12. A microcapsule according to claim 10 or 11 wherein the proportions of the surface modifying chemical relative to the wall forming material are such that there is an excess of total isocyanate groups present in the wall forming material over total groups –X.

13. A microcapsule according to claim 12 wherein ratio of the total moiety(ies) –NCO in the wall-forming material to the total reactive moiety(ies) –X in the surface modifying compound is from 2 : 1 to 25 : 1

14. A microcapsule according to any of claims 1 to 9 wherein the solid permeable shell of polymer resin is made by the polymerisation of a urea formaldehyde prepolymer in which the methylol ($-CH_2OH$) groups have optionally been partially etherified by reaction with a C_4-C_{10} alkanol, and the surface modifying compound reacts with the methylol or etherified methanol moieties in the urea formaldehyde wall forming material.

15. A microcapsule according to claim 14 wherein the mole ratio of the surface modifying agent to the number of urea-formaldehyde repeat units in the urea formaldehyde prepolymer is between 1:40 to 1:4.

16. A modified process for the encapsulation of a dispersed material within a solid permeable shell of a polymer resin formed by polymerisation of a wall-forming material which comprises incorporating a surface modifying compound having a formula (I), (II), (III), (IV) or (V) as defined in Claim 1 into the polymer resin.

17. A process according to claim 16 comprising

a) reacting the surface-modifying compound with at least one wall-forming material thereby forming a modified surface-active intermediate;

b) preparing an organic solution or oil phase comprising the material to be encapsulated, the modified surface-active intermediate, and, optionally, additional wall-forming material;

c) creating an emulsion of the organic solution in a continuous phase aqueous solution comprising water and, optionally, a protective colloid, wherein the emulsion comprises discrete droplets of the organic solution dispersed throughout the continuous phase aqueous solution, with an interface formed between the discrete droplets of organic solution and the aqueous solution; and either

d) causing *in situ* polymerization and/or curing of the modified wall-forming material in the organic solution of the discrete droplets at the interface with the aqueous solution by heating the emulsion for a sufficient period of time and optionally adjusting the pH to a suitable value to allow substantial completion of wall formation, thereby converting the organic solution droplets to capsules consisting of solid, permeable, polymer shells enclosing the material and having the surface modifying compound incorporated therein, or as an alternative to (d)

e) causing polymerization at the oil-water interface by bringing together a wall forming material added through the aqueous continuous phase and capable of reacting with the wall forming material(s) in the discontinuous oil phase.

18. A process according to claim 16 comprising

a) preparing an organic solution or oil phase comprising the material to be encapsulated, the surface modifying compound and the wall-forming material

b) creating an emulsion of the organic solution in a continuous phase aqueous solution comprising water and, optionally, a protective colloid, wherein the emulsion comprises discrete droplets of the organic solution dispersed throughout the continuous phase aqueous solution, with an interface formed between the discrete droplets of organic solution and the aqueous solution; and either

c) causing *in situ* polymerization and/or curing of the modified wall-forming material in the organic solution of the discrete droplets at the interface with the aqueous solution by heating the emulsion for a sufficient period of time and optionally adjusting the pH to a suitable value to allow substantial completion of wall formation, thereby converting the organic solution droplets to capsules consisting of solid, permeable, modified polymer shells enclosing the material; or as an alternative to (c)

(d) causing polymerization at the oil-water interface by bringing together a wall forming material added through the aqueous continuous phase and capable of reacting with the wall forming material(s) in the discontinuous oil phase.

19. A process according to claim 16 comprising

a) preparing an organic solution or oil phase comprising the material to be encapsulated and the wall-forming material;

b) creating an emulsion of the organic solution in a continuous phase aqueous solution comprising water and the surface-modifying compound(s), wherein the emulsion comprises discrete droplets of the organic solution dispersed throughout the continuous phase aqueous solution, with an interface formed between the discrete droplets of organic solution and the aqueous solution; and

c) causing *in situ* polymerization and/or curing of the wall-forming material so that the surface-modifying molecule(s) is incorporated into the wall by heating the emulsion for a sufficient period of time and optionally adjusting the pH to a suitable value, to allow substantial completion of wall formation, thereby converting the organic solution droplets to capsules consisting of solid, permeable, modified polymer shells enclosing the material.

20. A process according to claim 16 comprising

a) preparing an organic solution or oil phase comprising the material to be encapsulated and a first wall-forming material(s) ;

b) creating an emulsion of the organic solution in a continuous phase aqueous solution comprising water and the surface-modifying compound(s), wherein the emulsion comprises discrete droplets of the organic solution dispersed throughout the continuous phase aqueous solution, with an interface formed between the discrete droplets of organic solution and the aqueous solution whereupon the surface modifying compounds(s) react at the interface with wall forming material from the organic phase; and

c) causing polymerization at the oil-water interface by bringing together a second wall forming material added through the aqueous continuous phase and capable of reacting with the first wall forming material(s) in the discontinuous oil phase.

21. A process according to claim 16 wherein there is employed a combination of the processes claimed in claims 17to 20.

22. A process according to any of claims 16 to 20 wherein the wall forming material which reacts with the surface modifying compound is an is an isocyanate wall forming material.

23. A process according to any of claims 16 to 20 wherein the wall forming material which reacts with the surface modifying compound is a urea formaldehyde prepolymer in which the methylol ($-CH_2OH$) groups have optionally been partially etherified by reaction with a C_4-C_{10} alkanol.

24. The reaction product of a surface modifying compound having the formula (I), (II), (III), (IV) or (V) as defined in claim 1 and an isocyanate wall forming material or a urea formaldehyde prepolymer in which the methylol ($-CH_2OH$) groups have optionally been partially etherified by reaction with a C_4-C_{10} alkanol.

25. A microcapsule according to any of claims 1 to 14 or a process according to any of claims 15 to 21 wherein the encapsulated material is an agrochemical, an ink, a dye, a biologically active material or a pharmaceutical.

26. A method for modifying the soil mobility of an agrochemical which comprises encapsulating the agrochemical in a process according to any of claims 16 to 23 and modifying the surface properties by incorporating a surface modifying compound.